SUMMARY OF FIRE PROTECTION PROGRAMS FOR CALENDAR YEAR 1999

UNITED STATES DEPARTMENT OF ENERGY
OFFICE OF WORKER HEALTH AND SAFETY
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FOREWORD

This edition of the Annual Fire Protection Program Summary for the Department of Energy (DOE) continues the series started in 1972.

Since May 1950, an Annual Fire Protection Program Summary (Annual Summary) has been submitted by DOE's fire protection engineering community under the requirements of DOE's predecessor agencies: the Atomic Energy Commission (AEC) and the Energy Research Development Administration (ERDA). An Annual Summary is currently required by section 5a.(8) of DOE Order 231.1, "Environment, Safety and Health Reporting" which replaced DOE 5484.1, "Environmental Protection, Safety and Health Protection Information Reporting Requirements".

Accident reports required by DOE Order 231.1 are compiled within the Computerized Accident Incident Reporting System (CAIRS) from different field organization sources than those submitting the Annual Summary. Each quarter, CAIRS issues the Occupational Injury and Property Damage Summary that statistically reports on DOE loss topics such as fatalities, injuries, illnesses, fire, and non-fire losses. The Annual Summary however, takes a more comprehensive look at the DOE fire protection program. Fire loss statistics are provided, as are reports on a broad range of fire protection activities including; automatic suppression system performance, fire department responses, and the recurring cost of fire protection at DOE sites. Fire loss statistics from the Annual Summary are also validated with the CAIRS fire loss reports, and trended against the CAIRS non-fire loss data. Discrepancies with either loss statistic are investigated and corrected as necessary.

The report for calendar year (CY) 1999 was summarized from information sent to Headquarters by 44 out of 61 sites, representing approximately 87 percent of DOE's holdings. For comparison purposes, field offices are arranged according to the CAIRS reporting format, with a total of 19 categories represented. Abbreviations are identified in the Glossary, as are the DOE site reporting elements and major definitions.

In 1999, an initiative was undertaken to automate the Annual Summary reporting process to streamline data collection and provide a more through review of DOE Reporting Element activities. This action resulted in the delayed publication of the CY 1999 report until 2002. It is now possible however to view all Annual Summary Reporting Element responses since 1991 at the Site, Operations, Lead Program Secretarial Office and Headquarters levels. Additionally, a built-in reference to other DOE reporting activities (CAIRS and ORPS) is available that allows Reporting Elements and managers the opportunity to review all fire protection events along previously mentioned categories. For example, the information contained in this publication was extracted from the Annual Summary Application at the Headquarters level for CY 1999. To obtain a copy of the Annual Summary Application please contact Jim Bisker in the Office of Nuclear and Facility Safety Policy (EH-53) at 301.903.6542 or jim.Bisker@hq.doe.gov.

GLOSSARY

Field organization abbreviations:

AL	Albuquerque Operations
CH	Chicago Operations
FETC	Federal Energy Technology Centers
GFO	Golden Field Office
HQ	Headquarters (DOE)
ID	Idaho Operations
NPR	Naval Petroleum Reserves
NV	Nevada Operations
OK	Oakland Operations (California)
OFO	Ohio Field Office
ORO	Oak Ridge Operations
PA	Power Administrations[1]
PNR	Pittsburgh Naval Reactors Office
RF	Rocky Flats Operations
RL	Richland Operations
SNR	Schenectady Naval Reactors Office
SPR	Strategic Petroleum Reserves[2]
SR	Savannah River Operations
YM	Yucca Mountain Site Characterization Project Office

Site or M&O contractor abbreviations:

ALA	Ames Laboratory
ANLW	Argonne National Laboratory, West
ANLE	Argonne National Laboratory, East
AEMP	Ashtabula Environmental Management Project
BAPL	Bettis Atomic Power Laboratory
BNL	Brookhaven National Laboratory
ETTP	East Tennessee Technology Park
EML	Environmental Measurements Laboratory
FNAL	Fermi National Accelerator Laboratory
FEMP	Fernald Environmental Management Project
GJO	Grand Junction
HAN	Hanford Site[3]
INEEL	Idaho National Engineering & Environmental Laboratory
ITRI	Inhalation Toxicology Research Institute
KAPL	Knolls Atomic Power Laboratory
KCP	Kansas City Plant

1. Power Administration organizations are comprised of: the Alaska Power Administration (APA); the Bonneville Power Administration (BPA); Southeastern Power Administration (SEPA), Southwestern Power Administration (SWPA); and the Western Area Power Administration (WAPA).

2 Strategic Petroleum Reserve Sites include: Bayou Chochtaw, Big Hill,Bryan Mound and West Hackberry.

3 Hanford Site includes the Pacific Northwest National Laboratory

KSO	Kesserling Site
LBL	Lawrence Berkeley National Laboratory
LLNL	Lawrence Livermore National Laboratories
LANL	Los Alamos National Laboratories
MEMP	Miamisburg Environmental Management Project
MGN	Morgantown Federal Energy Technology Center
NREL	National Renewable Energy Laboratory[4]
NRF	Naval Reactor Facilities
NTS	Nevada Test Site[5]
NBL	New Brunswick Laboratory
ORISE	Oak Ridge-Institute of Science & Education
ORNL	Oak Ridge National Laboratories
PAN	Pantex Site
PGDP	Paducah Gaseous Diffusion Plant[6]
PNL	Pacific Northwest Laboratory
PGH	Pittsburgh Federal Energy Technology Center
POR	Portsmouth Gaseous Diffusion Plant[4]
PPPL	Princeton Plasma Physics Laboratory
ROSS	Ross Aviation, Inc.
SLAC	Stanford Linear Accelerator Center
SNLA	Sandia National Laboratories, Albuquerque
SNLL	Sandia National Laboratories, Livermore
SRS	Savannah River Site
TJNL	Thomas Jefferson National Accelerator Facility
WIPP	Waste Isolation Pilot Plant
WSS	Weldon Spring Site
WVDP	West Valley Demonstration Project
WS	Windsor Site
Y-12	Y-12 Plant
YM	Yucca Mountain Project

The below reference is used throughout the report to identify various DOE elements:

DOE field organization (abr.)/site (abr.)
Example: AL/LANL

[4] National Renewable Energy Laboratory includes the Wind Site

[5] Nevada Test Site Includes: Amador Valley Operations, Las Vegas Operations, Nevada-Los Almos Operations, Nevada-Special Technology Laboratory, Washington Aerial Measurements Operation, and Nevada-EG&G Wolburn NV.

[6] On July 1, 1993, a lease agreement took effect between the DOE and the United States Enrichment Corporation (USEC) essentially transferring all ownership responsibilities to USEC.

DEFINITIONS

The following terms are defined in the text of DOE Manual M 231.1-1, "Environment, Safety, and Health Reporting Manual." Major definitions not included in this manual have been extracted from the rescinded order DOE 5484.1 to clarify key concepts. Section references to these documents are given at the end of the definition.

1. **Property Value:** The approximate replacement value of all DOE-owned buildings and equipment. Included are the cost of all DOE-owned supplies and average inventory of all source and special nuclear materials. Excluded is the cost of land, land improvements (such as sidewalks or roads), and below ground facilities not susceptible to damage by fire or explosion (such as major water mains and ponds). (APPENDIX C, DOE M 231.1)

2. **Estimated Loss:** Monetary loss determination based on all estimated or actual costs to restore DOE property and equipment to preoccurrence conditions irrespective of whether this is in fact performed. The estimate includes: (1) any necessary nuclear decontamination; (2) restoration in areas that received water or smoke damage, (3) any reductions for salvage value, and (4) any lost revenue experienced as a result of the accident. The estimate excludes: (1) down time; and (2) any outside agency payments. Losses sustained on private property are not reportable, even if DOE is liable for damage and loss consequences resulting from the occurrence. Categorization of occurrences shall be by fire loss and non-fire loss events. (APPENDIX C, DOE M 231.1)

3. **Fire Loss:** All damage or loss sustained as a consequence of (and following the outbreak of) fire shall be classified as a fire loss. Exceptions are as follows: (1) burnout of electric motors and other electrical equipment through overheating from electrical causes shall be considered a fire loss only if self-sustained combustion exists after power is shut off. (APPENDIX C, DOE M 231.1)

4. **Non-fire Loss:** All damage or loss sustained as a consequence of the following events: (1) explosions; (2) natural cause events (such as earthquakes and hurricanes); (3) electrical malfunctions; (4) transportation (cargo) losses; (5) mechanical malfunctions; (6) radiation releases or other nuclear accidents; and (7) miscellaneous accidents (such as thermal, chemical or corrosion-related accidents). (CHAPTER 4.2.c, DOE 5484.1)

5. **Loss Rate:** Unit of comparison in cents loss per $100 of property value.

EXECUTIVE SUMMARY

DOE experienced no fatalities or major injuries from fire in CY 1999. However, 145 fire events were reported during the period causing an estimated $450,549 in property damage. These losses are approximately $134,074 more than fire losses sustained in CY 1998, with 22 percent of loss attributed to 1 incident.

Loss comparisons between the DOE and private industry are performed by normalizing data against total property value. In CY 1999 CAIRS reported an increase in property valuations over the previous year by 11.8 percent to 110.8 Billion dollars. The CY 1999 fire loss rate is therefore approximately 0.04 cents for each $100 in property value. This rate is 0.06 cents lower than the five year DOE average, and significantly less (0.60 cents) than private industry (non-nuclear) statistics.

DOE's success in reducing risk or incidence from fire is attributed to the implementation and maintenance of a comprehensive fire protection program, which compares favorably with the best of class in the private sector. This program includes the adoption of a "defense in depth" fire safety philosophy; conformance with industry standards and DOE-specific fire safety criteria for design, construction, and operation; fully capable site emergency response personnel; and, qualified fire safety professionals.

Recurring costs for fire protection exceeded 126.5 million dollars in CY 1999. On a ratio of cost to total property value, the DOE spent approximately 11.41 cents per $100 value for recurring fire protection activities or, 0.59 cents less then the previous year.

In CY 1999, 3 fires were controlled by automatic wet pipe sprinkler systems, continuing the DOE track record on sprinkler effectiveness at a 99 percent rate. The success of these fixed suppression systems were, however, offset by the inadvertent actuation of 51 systems primarily due to unspecified causes. Also, concerns remain regarding inadvertent Halon discharges (11 of the above 51 events), causing the release of approximately 1,298 pounds of Halon to the environment. DOE remains committed to minimizing this ozone depleting substance through implementation of its managed Halon phaseout guidelines

DOE PROPERTY LOSS EXPERIENCE

Property value estimates are taken from the CAIRS database and serve as a common denominator for comparing Annual Summary loss rates to the CAIRS Summary. CAIRS data shows that DOE property values increased approximately 11.8 percent in CY 1999.

In all, 145 fire incidents were reported by field organizations accounting for a total year-end fire loss of $450,549. Of these incidents, 129 fires were reported as falling below the CAIRS

threshold of $5,000. Field organizations reported through CAIRS, non-fire loss amounts totaling $2,467,991.

DOE's fire loss rate for CY 1999, as summarized from field organization reports, is approximately 0.04 cents loss per $100 property value; 21 percent more then last year's 0.03 cent figure. This statistic is also 2.3 times lower than the 1994-1998 DOE average of 0.10, continuing the downward trend in fire loss rates over previous years. By comparison, the five year loss rate average for the highly protected risk (HPR) insurance industry was about 0.64 cents per $100 value[7]. This success compared to private industry is attributed to a conservative, yet flexible fire safety program, as well as the efforts of DOE's safety professionals in identifying and mitigating fire hazards before they result in a loss.

Table 1 characterizes Annual Summary loss histories since 1950 and includes both fire and non-fire loss rate categories. Numbers shown in parentheses represent a 5-year running average, where applicable. The accompanying figures are described as follows:

Figure 1 - graphical representation of the Department's property valuation since 1950
Figure 2 - fire and non-fire property loss since 1979
Figure 3 - fire loss rates since 1984
Figure 4 - non-fire loss rates over the same time period
Figure 5 - the current year's fire event tally by Field Organizations
Figure 6 - the current year's fire loss (dollars) by Field Organizations
Figure 7 - the current year's fire loss rate by Field Organizations
Figure 8 - the current year's non-fire event tally by Field Organizations
Figure 9 - the current year's non-fire loss (dollars) by Field Organizations
Figure 10 - the current year's non-fire loss rate by Field Organizations

Organizations not shown on Figures 5 through 10 reported either insignificant or zero losses for the year.

Trending of fire loss data indicates that a small number of incidents constitute the majority of dollar losses reported to the DOE. For example, the largest fire incident accounted for approximately 22 percent of the total dollar loss amount.

The largest fire and non-fire losses for the year are noted below:

1. ID/INEEL – On August 19, 1999, the desert area North of ANL-West sustained a 39,680-acre wildland fire. Investigation determined the cause was lightning. This event was supported by the Bureau of Land Management. Damage estimated at $99,880.00

2. OR/ETTP – On June 24, 1999, at approximately 22:23, a localized, high strength wind caused damage to the K-33 Building and knocked out electrical power to K-33 and some surrounding buildings. Several dumpsters were blown significant distances (20 to 75

7. As reported by an HPR insurance company for standard business property loss from fires and explosions (1997).

feet), and a small aluminum building was blown over a security fence and up into the power lines. Damage to the K-33 building included three holes in the roof (the largest being approximately 60 to 80 feet) above Unit 8 totalling approximately 10,000 square feet of damage, and two holes (approxiamtely 150 square feet each) in the south wall 20-30 feet above ground level. The building materials were pulled up and away from the building - with the exception of minor debris the material did not fall inside the building. There were no injuries to personnel during the incident. The emergency response organization was onsite with a mobile first aid station the day of the occurrence to provide care in case of an accident during the investigation and reopening of the building. Services were not needed. Damage estimated at $1,650,000.00

The 1999 fourth quarter CAIRS report identified 8 fire incidents over the year resulting in a loss of $227,513; approximately $223,000 less than the Annual Summary. Most of this difference can be traced to the ID/INEEL wildland fire incident, with the remaining discrepancy linked to other incidents that were not incorporated into the CAIRS database. The CAIRS report also lists 16 non-fire incidents producing losses of $2,467,991. ORPS identifies a total of 54 fire events over CY 1999 in which fire exceeded the minimum 10 minute reporting threshold.

This report has historically identified discrepancies between Annual Summary field reports and that of either CAIRS or ORPS databases. In many instances, these discrepancies were traced to either: reporting threshold differences, delayed reporting, cost estimating differences, improper loss characterization, or a misinterpretation on the need to file a report at all. Since loss statistics from CAIRS and ORPS are often extracted for use in other documents such as reports to Congress, performance indicator studies, and media releases, an incomplete reflection of DOE fire loss history is often the result. Database administrators are addressing these issues by increased field training programs and by streamlining the reporting process using state of the art electronic technology. A part of this technology includes developing a "seamless" approach using a library of definitions that allows the sharing of data across multiple database applications.

Table 1

DOE Loss History From 1950 To Present

Year	Property Value (Millions of Dollars)	Fire Loss (Dollars)	Non-fire Loss (Dollars)	Loss Rates (cents per 100 Dollar Value) Fire*	Non-Fire*	Total*
50	1,800.00	486,389	10,050	2.70 -	0.06 -	2.76 -
51	2,177.10	38,318	317,797	0.18 -	1.46 -	1.64 -
52	3,055.10	449,107	356,600	1.47 -	1.17 -	2.64 -
53	4,081.00	148,142	427,430	0.36 -	1.05 -	1.41 -
54	6,095.90	185,438	190,436	0.30 -	0.31 -	0.62 -
55	6,954.20	125,685	330,103	0.18 (1.00)	0.47 (0.81)	0.66 (1.81)
56	7,364.10	2,206,478	940,945	3.00 (0.50)	1.28 (0.89)	4.27 (1.39)
57	7,973.20	590,663	885,936	0.74 (1.06)	1.11 (0.86)	1.85 (1.92)
58	8,102.50	275,560	476,265	0.34 (0.92)	0.59 (0.84)	0.93 (1.76)
59	10,301.80	199,841	998,060	0.19 (0.91)	0.97 (0.75)	1.16 (1.67)
60	10,708.60	636,228	764,823	0.59 (0.89)	0.71 (0.88)	1.31 (1.77)
61	11,929.90	325,489	5,530,566	0.27 (0.97)	4.64 (0.93)	4.91 (1.91)
62	12,108.80	3,020,023	293,341	2.49 (0.43)	0.24 (1.60)	2.74 (2.03)
63	13,288.90	599,056	776,998	0.45 (0.78)	0.58 (1.43)	1.04 (2.21)
64	14,582.80	480,519	870,516	0.33 (0.80)	0.60 (1.43)	0.93 (2.23)
65	15,679.30	1,743,448	2,106,621	1.11 (0.83)	1.34 (1.35)	2.46 (2.18)
66	16,669.00	158,220	698,753	0.09 (0.93)	0.42 (1.48)	0.51 (2.41)
67	17,450.90	359,584	2,423,350	0.21 (0.90)	1.39 (0.64)	1.59 (1.53)
68	18,611.90	155,986	713,097	0.08 (0.44)	0.38 (0.87)	0.47 (1.31)
69	20,068.30	27,144,809	909,525	13.53 (0.37)	0.45 (0.83)	13.98 (1.19)
70	22,004.30	89,456	1,611,336	0.04 (3.00)	0.73 (0.80)	0.77 (3.80)
71	24,155.80	78,483	1,857,566	0.03 (2.79)	0.77 (0.68)	0.80 (3.47)
72	26,383.50	222,590	698,061	0.08 (2.78)	0.26 (0.75)	0.35 (3.52)
73	27,166.70	117,447	2,258,241	0.04 (2.75)	0.83 (0.52)	0.87 (3.27)
74	28,255.50	249,111	930,766	0.09 (2.75)	0.33 (0.61)	0.42 (3.36)
75	31,658.30	766,868	4,485,481	0.24 (0.06)	1.42 (0.59)	1.66 (0.64)
76	35,512.70	251,849	2,040,727	0.07 (0.10)	0.57 (0.72)	0.65 (0.82)
77	39,856.10	1,084,823	2,529,161	0.27 (0.11)	0.63 (0.68)	0.91 (0.79)
78	47,027.10	12,976,036	4,501,943	2.76 (0.14)	0.96 (0.76)	3.72 (0.90)
79	50,340.80	654,716	1,886,307	0.13 (0.69)	0.37 (0.78)	0.50 (1.47)
80	54,654.70	1,385,686	7,160,249	0.25 (0.69)	1.31 (0.79)	1.56 (1.49)
81	59,988.80	2,042,633	2,600,855	0.34 (0.70)	0.43 (0.77)	0.77 (1.47)
82	65,360.40	948,691	3,252,277	0.15 (0.75)	0.50 (0.74)	0.64 (1.49)
83	70,484.40	731,234	9,765,828	0.10 (0.73)	1.39 (0.71)	1.49 (1.44)
84	82,166.90	1,549,807	4,917,513	0.19 (0.19)	0.60 (0.80)	0.79 (0.99)
85	86,321.84	1,145,975	2,983,322	0.13 (0.21)	0.35 (0.85)	0.48 (1.05)
86	82,787.52	805,030	4,490,262	0.10 (0.18)	0.54 (0.65)	0.64 (0.83)
87	91,927.20	1,570,736	1,440,093	0.17 (0.13)	0.16 (0.67)	0.33 (0.81)
88	92,998.00	466,120	7,837,000	0.05 (0.14)	0.84 (0.61)	0.89 (0.74)
89	107,948.00	615,551	6,890,000	0.06 (0.13)	0.64 (0.50)	0.70 (0.63)
90	115,076.00	8,392,746	9,078,000	0.73 (0.10)	0.79 (0.51)	1.52 (0.61)
91	118,868.68	608,740	1,820,065	0.05 (0.22)	0.15 (0.59)	0.20 (0.81)
92	118,267.06	1,166,858	2,486,696	0.10 (0.21)	0.21 (0.52)	0.31 (0.73)
93	119,826.25	679,939	2,338,595	0.06 (0.20)	0.19 (0.53)	0.25 (0.73)
94	124,350.29	1,533,717	1,869,933	0.12 (0.20)	0.15 (0.40)	0.27 (0.60)
95	120,321.68	720,720	911,746	0.06 (0.21)	0.08 (0.30)	0.14 (0.51)
96	113,471.00	2,372,482	3,653,350	0.21 (0.08)	0.32 (0.16)	0.53 (0.24)
97	102,947.24	544,924	5,567,963	0.05 (0.11)	0.54 (0.19)	0.59 (0.30)
98	99,127.79	316,475	1,062,313	0.03 (0.10)	0.11 (0.26)	0.14 (0.36)
99	110,858.47	450,549	2,467,991	0.04 (0.10)	0.22 (0.24)	0.26 (0.34)

*Numbers shown in parentheses represent the 5-year running average.

Figure 1

DOE Property Valuation

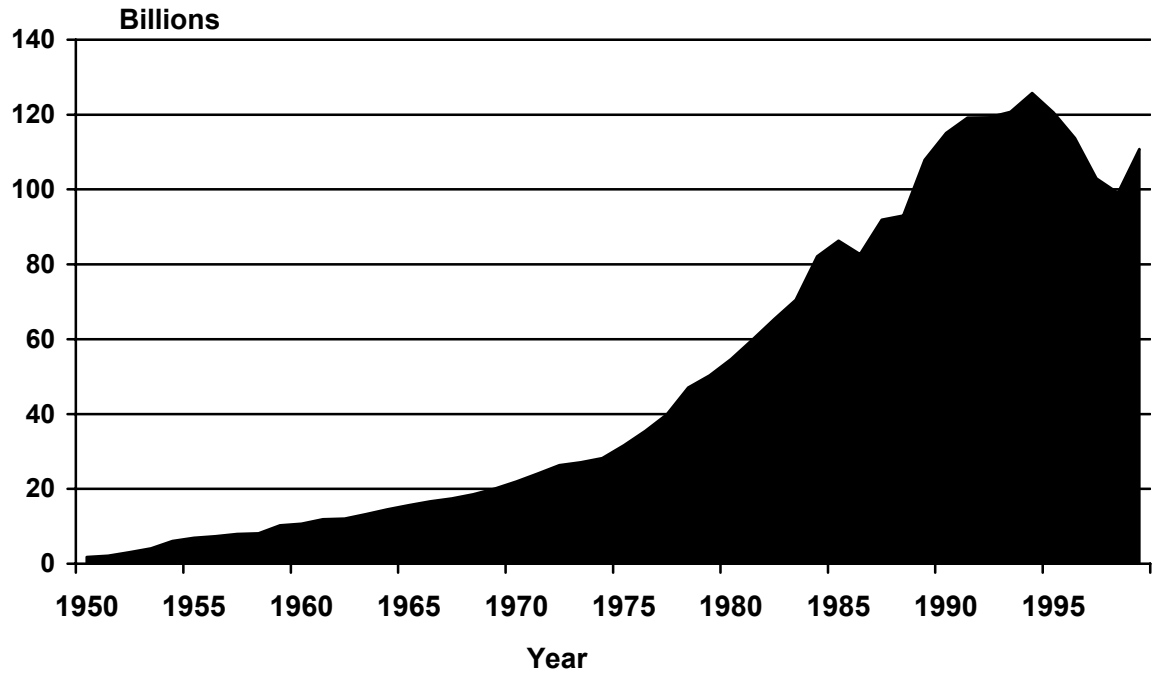


Figure 2

Property Loss

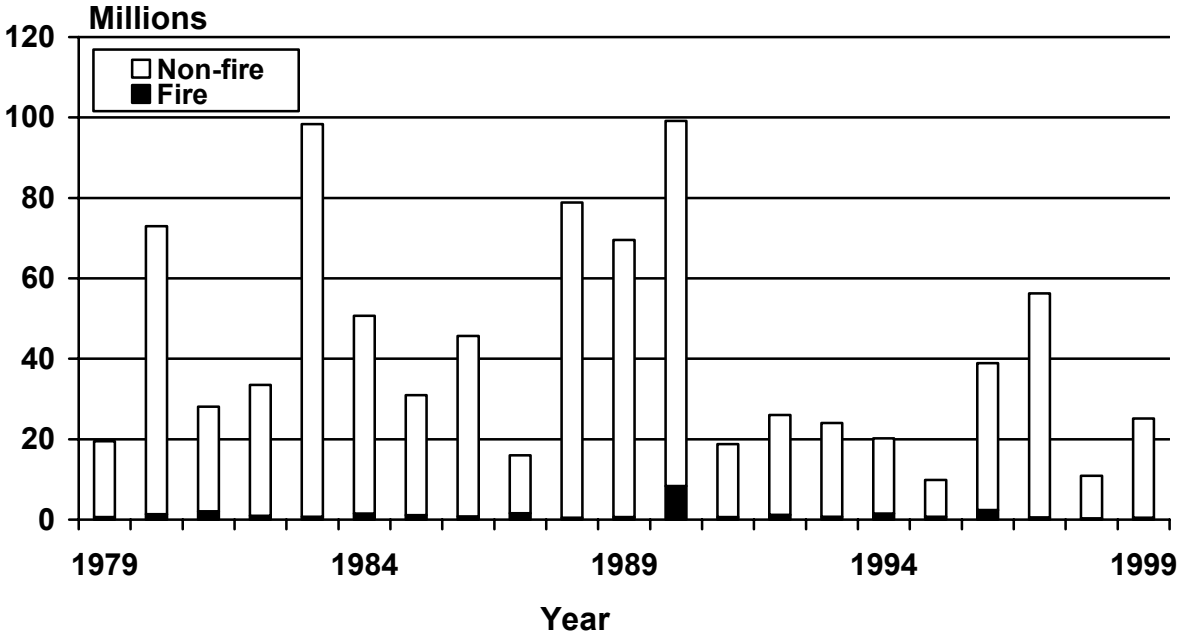


Figure 3

DOE Fire Loss Rate

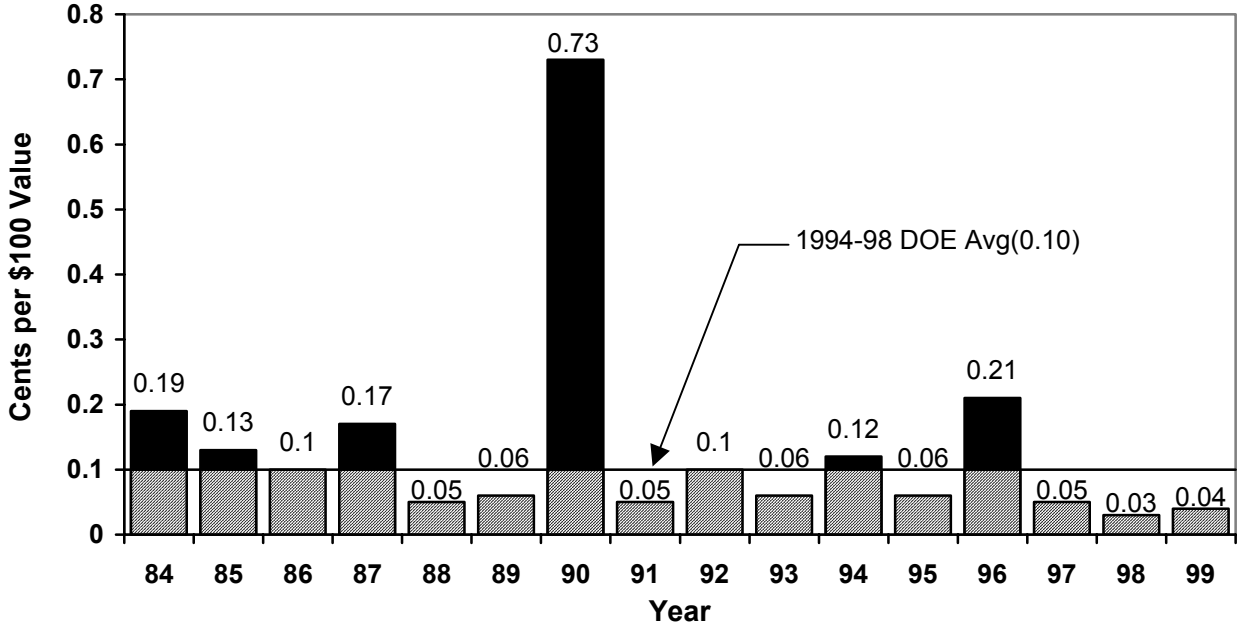


Figure 4

DOE Non-fire Loss Rate

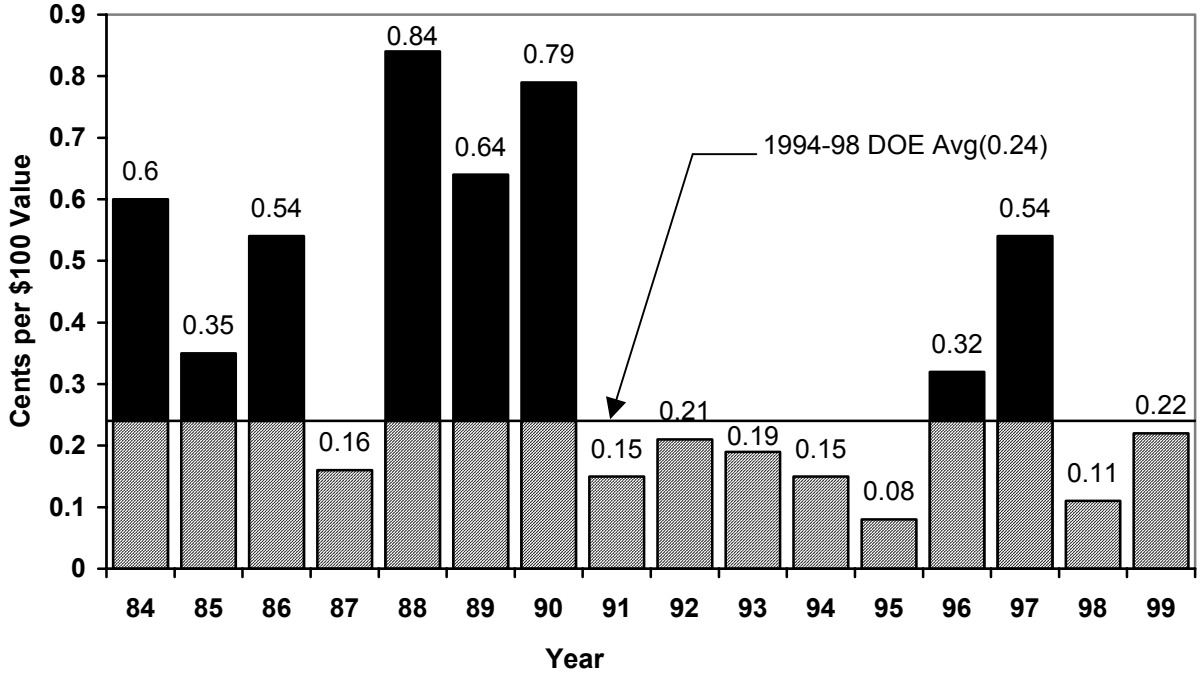


Figure 5

Fire Events by Field Organization

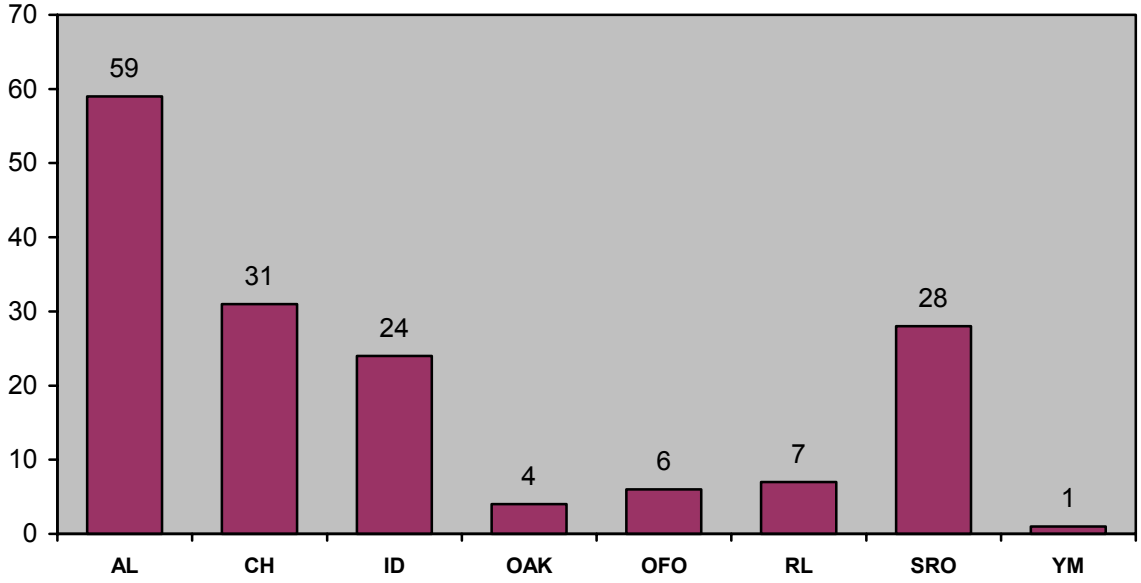


Figure 6

Fire Loss Amount by Field Organization

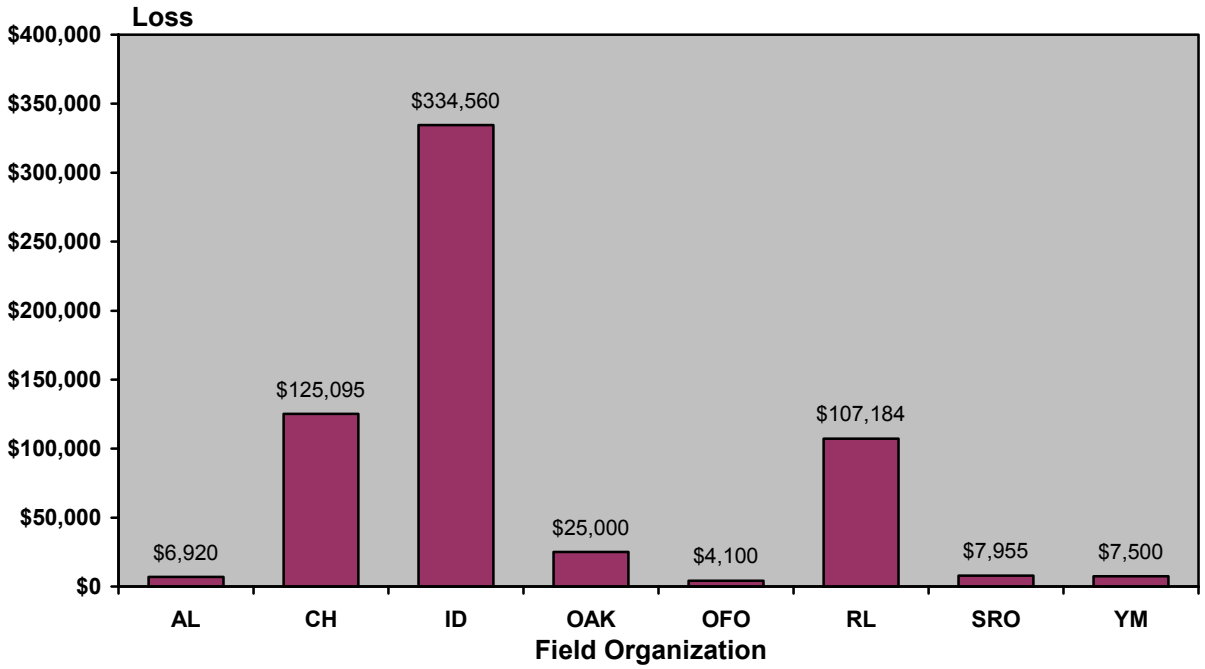


Figure 7

Fire Loss Rate by Field Organization

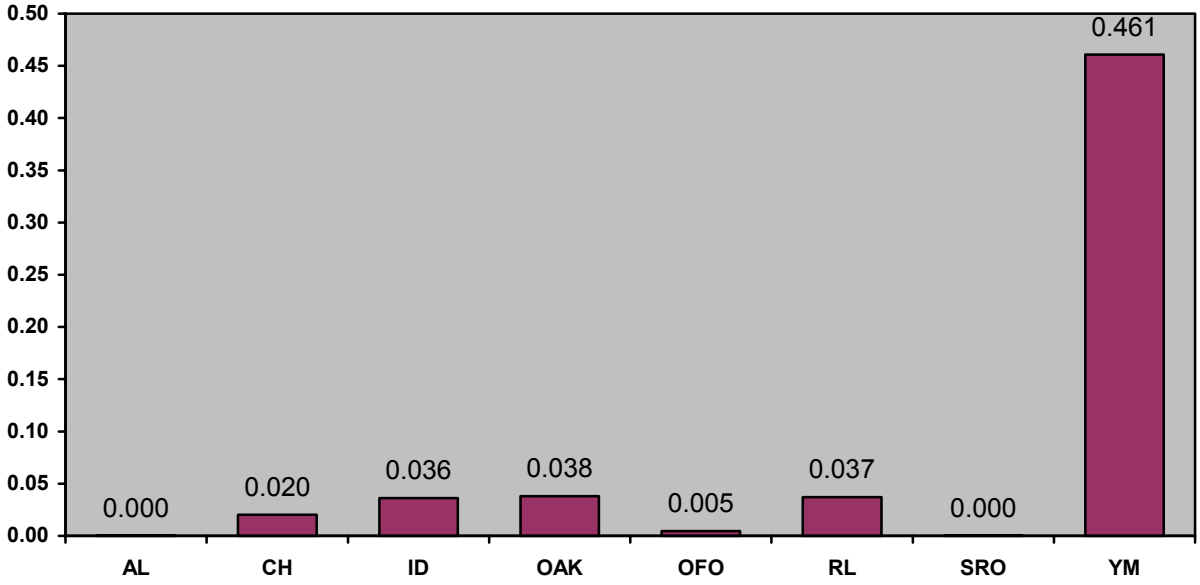


Figure 8

Non-fire Loss Events by Field Organization

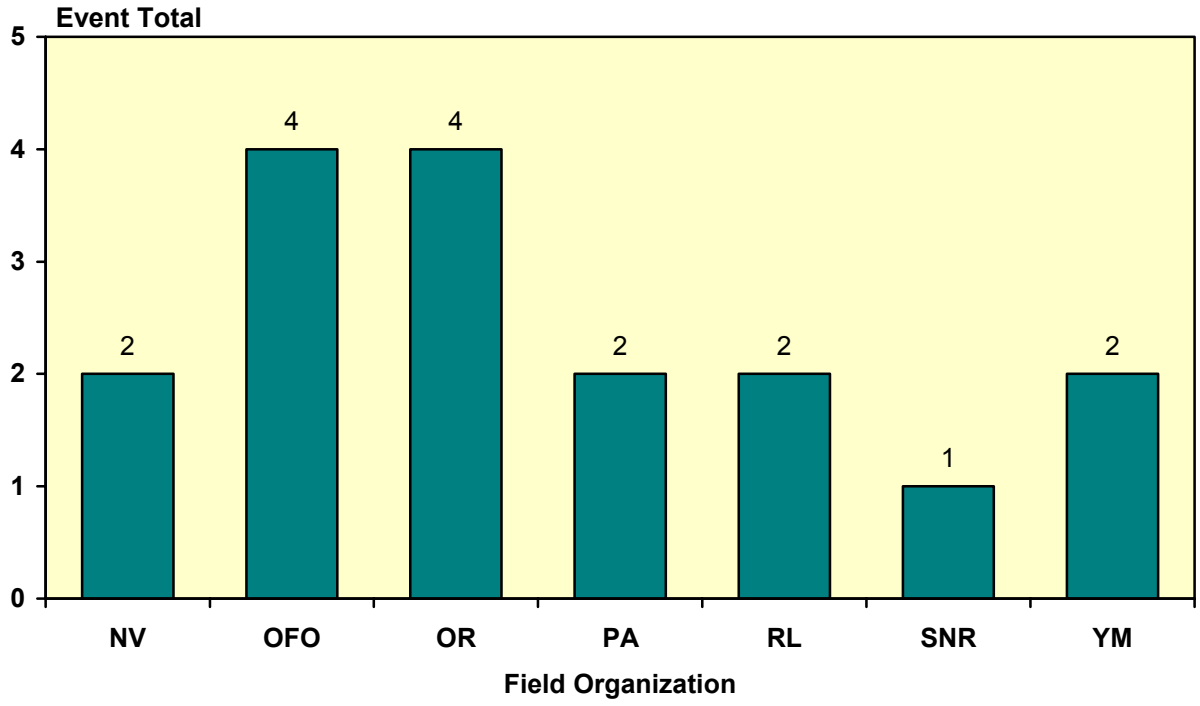


Figure 9

Non-fire Loss Amount by Field Organization

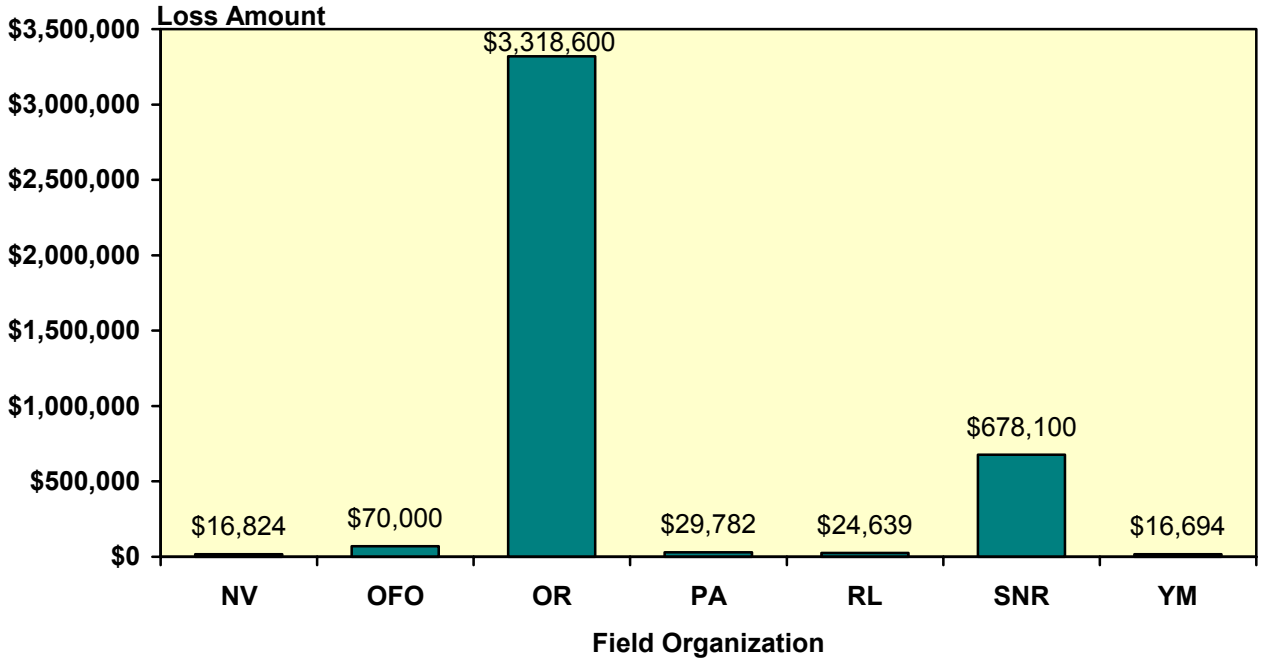
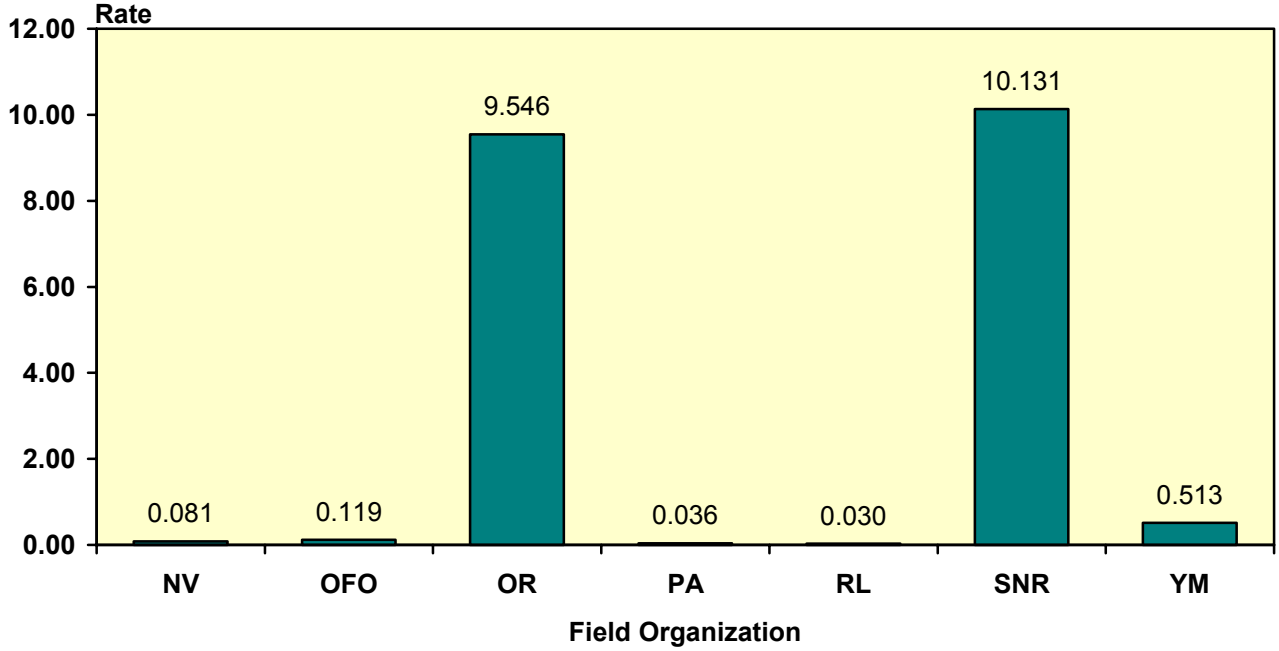


Figure 10

Non-fire Loss Rate by Field Organization



SUMMARY OF FIRE DAMAGE INCIDENTS

The following table provides a brief description notable DOE fire losses over the year:

Table 2: **Summary of Fire Damage Incidents For CY-99**

LOSS TYPE	LOCATION	DESCRIPTION	DOLLAR LOSS
Fire/Smoke (Brush)	ID / INEEL	39,680-acre wildland fire. Investigation determined the cause was lightning. Supported by the Bureau of Land Management.	$99,880.00
Fire/Smoke (Building)	CH / BNL	High voltage electrical arcing across a plastic encased capacitor in a Pulsed Fired Network power supply resulted in a fire at the National Synchrotron Light Source (NSLS). Operations personnel first heard the electrical arcing and then saw flames within the power supply cabinet. After turning off the high voltage power to the equipment, they attempted to use fire extinguishers to put out the fire. Smoke detection above the area summoned the fire department. Damage was limited to the interior of the equipment cabinet. The National Synchrotron Light Source injector system was out of service for one week until the power supply used to provide the Klystron was repaired. As a result, the NSLS has filed a CAIRS report for the incident.	$95,000.00
Fire/Smoke (Building)	RL / HAN	An outside floodlight loosened on its mounting bracket and came into contact with combustible components on the Mobile Office. The fire department responded to the incident and extinguished the fire.	$62,694.00
Fire/Smoke (Brush)	ID / INEEL	35,000-acre wildland fire. Investigation determined the cause was lightning. Support requested by the Bureau of Land Management.	$60,700.00
Fire/Smoke (Building)	RL / HAN	A small in-cell fire was discovered in a waste container within B-cell. Operations personnel extinguished the fire within about 10 minutes. There was no release to the environment and there were no adverse impacts to the facility, personnel, or the public.	$26,991.00
Fire/Smoke (Building)	OAK / LLNL	A desk fan that had been left on to prevent computer from overheating, itself overheated and melted its base. When it fell to the floor, it ignited a chair. The fire actuated the building sprinkler system and notified the Fire Department.	$14,000.00
Fire/Smoke (Building)	CH / ANLE	On Wednesday, November 24 at 0835 an occupant of Building 200 R-Wing called the ANL-E fire department for visible smoke in the corridor at that location. Upon arrival, the fire department determined that the smoke was coming from the metal ductwork located above the suspended ceiling. An electrical heating coil inside the duct overheated and caught the surrounding	$12,250.00

Table 2: **Summary of Fire Damage Incidents For CY-99**			
LOSS TYPE	**LOCATION**	**DESCRIPTION**	**DOLLAR LOSS**
		Class A material on fire. Firefighters quickly extinguished the fire and performed salvage and overhaul work in the following minutes. Mutual aid was also requested from the area communities.	
Fire/Smoke (Other)	YM / YM	NOTE: TAKEN FROM CAIRS REPORT. Employee was driving the Drill rig to the subdock when an oil line ruptured and a fire erupted in the right engine compartment. The rear escort notified driver that the rig was on fire. The fire was extinguished in less than 10 minutes, using three (3) 20 lbs. fire extinguishers and on (1) 5 lb. extinguisher. Fire department and county sheriff responded and completed reports. Damage was sustained in the area of the engine compartment - to the Kelly hose; hydraulic hoses; engine wiring and gauges. Preliminary costs est. = $7,500. Approximately 45 gallons of contaminated solid was removed.	$7,500.00
Fire/Smoke (Vehicle)	RL / HAN	A gas engine, rags, and coveralls were located in the bed of a pickup and the heat from the gas engine ignited the rags/coveralls. The fire department extinguished the fire.	$7,236.00
Fire/Smoke (Building)	AL / SNL	SNLA A small fire broke out in the custodial closet in building 996 engaging the fire suppression sprinkler system. Appropriate emergency response organizations responded to mitigate the event. The fire was apparently caused when a floor dust mop was placed too close to a hot water heater. Besides the smoke and water damage to the building, the floor mop, a vacuum cleaner and buffer were also damaged. Building was evacuated and there were no injuries. $6,000 ALO-KO-SNL-NMFAC-1999-0001	$6,000.00
Fire/Smoke (Building)	CH / FNAL	Investigated an Automatic Alarm from MI-60. Interior investigation determined that smoke was present in the building. FD Personnel with SCBA completed an interior investigation that indicated a power supply at the North End had failed. MCR Personnel stated that the power to the ring had been turned off, LOTO was underway for the MI-60 Building and Power Supply. Further investigation after the building was ventilated revealed that the MI-60 Lower Power Supply had malfunctioned and burned. Damage estimates were made by MCR Personnel. BD Personnel were to make notification to their Division Superiors. Photos were taken, the area turned over to MCR Personnel. T-2 was released. All FD Units returned to quarters in service.	$6,000.00
Fire/Smoke (Building)	RL / HAN	A fan overheated in the elevator shaft emitting smoke from the shaft.	$5,842.00
Fire/Smoke (Brush)	ID / INEEL	1,500-acre wildland fire. Investigation determined the cause was lightning. Supported by the Bureau of	$5,100.00

Table 2: **Summary of Fire Damage Incidents For CY-99**			
LOSS TYPE	**LOCATION**	**DESCRIPTION**	**DOLLAR LOSS**
		Land Management.	
Fire/Smoke (Building)	OAK / SLAC	Double wide trailer type modular building was damaged by fire. The fire started adjacent to a space heating coil mounted on the outside of the wall. The building had minor structural damage to its ceiling and roof.	$5,000.00
Fire/Smoke (Building)	CH / FNAL	While en route, dispatcher notified FD responders that a burned compressor motor caused the alarm. Upon arrival at the scene, Acting Capt. was met by (01047N), who stated that one of the compressor motors had overheated, smoked, and activated the detector. The alarm was reset, and command was terminated.	$5,000.00
Fire/Smoke (Building)	OAK / LBL	Overheated diesel engine block heated after a maintenance technician drained the coolant.	$5,000.00

WATER-BASED AUTOMATIC SUPPRESSION SYSTEM PERFORMANCE

A total of 42 incidents were reported where water-based suppression systems operated in CY 1999: 21 were wet-pipe systems, 11 dry-pipe, 6 deluge, 2 foam, 1 preaction and 1 water mist. Of the wet-pipe system activations, three events were directly related to fire. Other system activations were caused by the following events: acts of nature/freezing conditions(7), employee related(9), design/material related(9), unspecified/other (15).

Water-based system activations of interest are listed in Table 3.

Table 3: **Water Based System Actuations**			
LOSS TYPE	**LOCATION**	**DESCRIPTION**	**DOLLAR LOSS**
Fire/Smoke (Building)	OAK / LLNL	A desk fan that had been left on to prevent computer from overheating, itself overheated and melted its base. When it fell to the floor, it ignited a chair. The fire actuated the building sprinkler system and notified the Fire Department.	$14,000.00
Fire/Smoke (Building)	AL / SNL	SNLA A small fire broke out in the custodial closet in building 996 engaging the fire suppression sprinkler system. Emergency response organizations responded to mitigate the event. The fire was apparently caused when a floor dust mop was placed too close to a hot water heater. Besides the smoke and water damage to the building, the floor mop, a vacuum cleaner and buffer were also damaged. Building was evacuated and there were no injuries. $6,000 ALO-KO-SNL-NMFAC-1999-0001	$6,000.00

Table 3: **Water Based System Actuations**			
LOSS TYPE	**LOCATION**	**DESCRIPTION**	**DOLLAR LOSS**
Fire/Smoke (Building)	AL / LANL	A portable butane burner malfunctioned and caused a fire in the cafeteria. A cafeteria worker used a fire extinguisher to put out the fire. A sprinkler head above the burner actuated and caused the entire building to be evacuated. Approximately 3,000 gallons of water was released by the fire suppression system. ADOADMIN-1999-0003	$0.00
Release	CH / ANLE	The Argonne fire department responded to Building 205 for an activated sprinkler alarm. Once inside, it was determined that the sprinkler head opened due to the fact that a lower temperature rated sprinkler head was used to replace a bad sprinkler head located in front of a unit heater. The water was quickly secured to the system.	$15,000.00
Leaks, Spills, Releases	CH / FNAL	On arrival, an audible alarm was sounding, no personnel were in the building at the time, Security and MCR personnel were on the scene. Investigation of the alarm revealed that Helium compressor #4 overheated and released oil by volume and mist.	$1,000.00
Release	CH / FNAL	Responded to Wilson Hall General Alarm, later determined to be Ramsey Auditorium. While en route the FD was advised that there was a large amount of water flowing down the stairs at the West side of the building.	$500.00
Release	RL / HAN	A sprinkler head fused due to high heat in the metal building causing the dry pipe sprinkler system to activate. There was no damage as a result of the incident. The head was replaced with a higher temperature	$500.00
Release	CH / FNAL	On arrival, FD investigated and found a broken tee fitting under the trash compactor feeding a sprinkler head. It had apparently frozen and split, causing water to flow.	$100.00
Release	CH / W	During the acceptance testing of a new backup electrical generator, the temperature near a sprinkler reached the point where the head opened. The system was valved off and the valving was manned during the duration of the testing	$0.00
Release	AL / KCP	During a preplanned utility shutdown, electrical service was turned off to a basement equipment room. The steam coil was left active with the fan not functioning, allowing for the build up of heat in the space and actuating sprinklers. Water was confined to the concrete AHU equipment room. No equipment was damaged.	$0.00
Release	OR / Y-12	Foamwater System 1. Human Error. Detection system problem panel wet down during 2/2/99-system discharge and not dried.	$0.00
Release	AL / LANL	The operations center received a supervisory trouble alarm. A JCNNM facility supervisor responded and secured the AC current to the fire alarm panel, and then reenergized the panel. This action caused all the zone fire alarms to ring into the TA-55 facility control system (FCS). The FCS interpreted the alarms as a fire condition and actuated the fire suppression system. Water flowed for about six seconds into the exhaust plenums. Communications error was the direct	$0.00

Table 3: **Water Based System Actuations**			
LOSS TYPE	**LOCATION**	**DESCRIPTION**	**DOLLAR LOSS**
		cause of this problem while the root cause was a defective or failed part. TA55-1999-0037	
Release	AL / LANL	Freezing water broke a sprinkler head and actuated the building fire alarm system. Inadequate administrative controls were a direct cause of this incident. Several similar incidents have occurred since the 1970's and in spite of the lessons learned and in spite of the lessons learned and NFPA requirements, neither CMR facility management nor Laboratory Fire Protection Personnel performed a formal review of the facilities wet pipe systems to determine the existence of freeze damage vulnerabilities. CMR-1999-0003	$0.00
Release	AL / SNL	SNLA Event 673 Personnel were moving a 10' stepladder when it came into contact with a Fire Sprinkler Head causing damage/leak to develop causing intermitted Fire Alarm Bell activations. IC responded and evacuated the building. IC returned the area to normal operations and allowed building personnel to enter the building. No further action taken.	$0.00
Release	OR / Y-12	Wet Pipe System 1W. Human Error. Fork Lift Hit Sprinkler Head	$0.00
Release	RL / HAN	A deluge system protecting an exterior transformer discharged due to a water surge. Changes have been made to the water supply system to minimize water surges.	$0.00
Release	ID / INEEL	Inadvertent actuation of the dry pipe fire suppression system. There were no fire sprinkler heads activated and no water was discharged.	$0.00
Release	OR / Y-12	Foam Water System 1. Act of Nature. Insects in Heat Detector.	$0.00

There are now a total of 239 incidents in DOE records where sprinkler systems operated in a fire. The satisfactory rate of performance is 99.2 percent, or 237 times out of 239 incidents. The two failures during a fire were attributed to; a closed cold weather valve in 1958 controlling a single sprinkler in a wood dust collector and, a deluge system failure due to a hung-up trip weight in a 1963 transformer explosion.

From the above history, DOE has experienced 111 fires that were either controlled or extinguished by the wet-pipe type of automatic suppression system. Table 4 below provides a summary on the number of sprinklers actuated to control or extinguish a fire against the number of occurrences where this event was reported. For example: 95 percent of these fires were controlled or extinguished with 4 or less sprinklers activating, 91 percent were controlled with 3 or less sprinklers activating, and so on.

The significance of this table is to highlight actual performance on systems that have been installed according to standard design practices (in this case the National Fire Protection Association (NFPA) Standard 13, Installation of Sprinkler Systems). By comparing the actual performance to design requirements, the designer or reviewer can get a sense of the conservativeness of the design requirement and adjust the design where necessary. Sprinkler

system water containment, for example, could rely on actual performance rather than strict design practice, since no specific design criteria exist on the subject.

Table 4
DOE Wet-Pipe Automatic Suppression Performance

Number of Sprinkler heads Activated per Fire Event	Number of Events	Cumulative Total of Events	Percentage of Event	Cumulative Percentage of Events
1	78	78	70	70
2	18	96	16	86
3	5	101	5	91
4	4	105	4	95
5	2	107	2	96
6	1	108	1	97
7	2	110	2	99
8	0	110	0	99
9+	1	111	1	100

NON WATER-BASED FIRE SUPPRESSION SYSTEM PERFORMANCE

Concerns regarding the effect of chlorinated fluorocarbons (CFCs) and Halon on the ozone layer have led to their regulation under the 1991 Clean Air Act. The Environmental Protection Agency has subsequently published rules on this regulation to include; prohibiting new Halon production, establishing container labeling requirements, imposing Federal procurement restrictions, imposing significant Halon taxes, issuing requirements for the approval of alternative agents, and listing essential areas where Halon protection is considered acceptable.

DOE's current policy does not allow the installation of any new Halon systems. Field organizations have been requested to aggressively pursue alternative fire suppression agents to replace existing systems and to effectively manage expanding Halon inventories. The long-term goal is the gradual replacement of all Halon systems.

In CY 1999, the DOE had 614 Halon 1301 systems in operation containing approximately 171,448 pounds of agent. Stored Halon 1301 inventory was reported at approximately 136,390 pounds. Operational and stored inventory amounts for the Halon 1211 were reported at 100,589 and 17,046 pounds, respectively.

Field organizations reported that 68 non-essential systems have been disconnected in 1999, adding approximately 41,900 pounds to DOE's stored Halon inventory.

Table 5 provides a breakdown of the five largest Halon utilizing field organizations, listing both Halon 1301 (fixed system extinguishing agent) and Halon 1211 (portable extinguishing agent). Agent Drawdown amounts represent the amount of Halon that was released to the environment over the calendar year. The bulk of Halon utilized within the Power Administrations[8] is located at WAPA.

Table 5
Primary DOE Sites Utilizing Halon Suppression Systems

LOCATION	HALON 1301		AGENT DRAWDOWN	HALON 1211	
	ACTIVE (lbs.)	INVENTORY (lbs.)		ACTIVE (lbs.)	INVENTORY (lbs.)
SR*	40897	34660	931	2723	803
AL	32430	32064	0	46294	4992
CH	35182	22977	0	18415	206
PA	10828	2331	0	2155	0
SPR	13557	0	0	3	0
Total	132894	92032	931	69590	6001

* Designated as DOE's Halon bank .

A total of 12 incidents were reported at DOE where Halon 1301 or other non-water based suppression systems operated in CY 1999. No sites reported any system failures during a fire. Additionally, approximately 1298[9] pounds of Halon 1301 were released in these events. A brief description of Halon actuations, as well as other non-water based system actuations are provided in Table 6 below.

Table 6
Non Water Based System Actuations

LOSS TYPE	LOCATION	DESCRIPTION	DOLLAR LOSS
Release	RL / HAN	The RMC Line halon system protecting the gloveboxes discharged due to a mechanical failure of a manual pull box for activating the system. The plastic around the set screw on a manual pull box fatigued allowing the box to activate and causing the halon system to discharge	$9,890.00
Release	OAK / LBL	Accidental discharge of a Halon 1301 system inside a sub-floor area of an accelerator control room.	$0.00
Release	ID / INEEL	Explosion suppression sphere was damaged during removal, discharging 15 pounds of Hymix (Halon 1301 and Dry Chemical	$0.00

8 In CY 1996, BPA ceased reporting any losses according to DOE O 231.1. Last known Halon amounts for the BPA were 14,495 lbs. in 6 systems and are not reflected in the current DOE totals.

9 The above figure does not consider system leakage in a stable condition.

LOSS TYPE	LOCATION	DESCRIPTION	DOLLAR LOSS
		mixture). The damaged sphere and the additional seven suppression spheres were removed and transferred to CFA-695. The explosion suppression system was previously tagged out-of-service.	
Release	SRO / SRS	Halon discharge in 221-F in the 6th level scrubber room	$0.00
Release	SRO / SRS	Halon discharge in 221-HB Line, 6th Level, Section #3, Zone #3. Halon alarm came in then the detector alarm.	$0.00
Release	SRO / SRS	Halon discharge in 221-H in the Hot Crane. There was an odor of electrical wires burning but no evidence of electrical damage found.	$0.00
Release	SRO / SRS	Halon discharge in 221-F, New Hot Crane. One 28# cylinder was recharged and returned to service.	$0.00
Release	SRO / SRS	Halon discharge in 735-A, D-138. Two 168# and one 180# cylinders were recharged and returned to service.	$0.00
Release	SRO / SRS	Halon discharge in 221-H, New Warm Crane. One 25# cylinder was recharged and returned to service.	$0.00
Release	SRO / SRS	Halon discharge in 221-F, Zone 322. Maintenance was welding in area.	$0.00
Release	SRO / SRS	SRS lists the total amount of Halon losses due to activities at the Halon Bank Charging Station for the Calendar Year .	$0.00
Release	AL / WIPP	An automatic dry chemical fire suppression system was found discharged on an underground rock bolter machine. No personnel were in the area when the discharged occurred. The discharge was apparently due to the vehicle having been washed and subsequently m	$0.00

Comparing total Halon stores reported in CY 1999 (307,838 pounds) to those reported in CY 1998 (350,426 pounds) indicates that DOE's Halon supply shrunk by 42,588 pounds. Comparing this difference to the drawdown amount (1,298 pounds) leaves a discrepancy of approximately 41,290 pounds. This discrepancy relates to amounts transferred to the DOE Halon Bank (15,814) and amounts sold at public auction (25,476)

Sites considering any Halon transfers outside the DOE are reminded that a Halon bank has been established so that reserve capacity can be maintained for mission essential systems in the complex that have not yet been replaced. The SR Fire Department may be contacted for further information regarding Halon transfers.

RECURRING FIRE PROTECTION PROGRAM COSTS

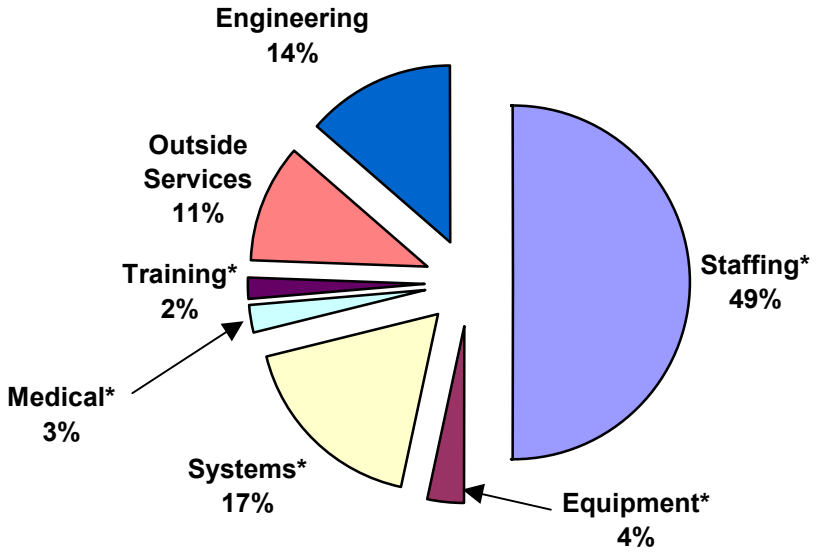
Yearly or recurring fire protection costs for CY 1999 reached $126,521,121. for the DOE Complex. On a ratio of cost to CAIRS property value (recurring cost rate) , the DOE spent approximately 11.41 cents per $100 property value for recurring fire protection activities, down 0.59 cents from the previous year.

Figure 11 shows the CY 1999 recurring cost distribution by activity . Figure 12 lists the recurring cost rate by DOE field organizations. It should be noted that not all recurring cost activities were consistently reported, such as outside contracts and maintenance activities. Additionally, sites that did not report recurring costs this calendar year (primarily ETTP, Sandia

and LANL) had their costs carried forward from the past reporting period to maintain the validity of the statistic.

Figure 11

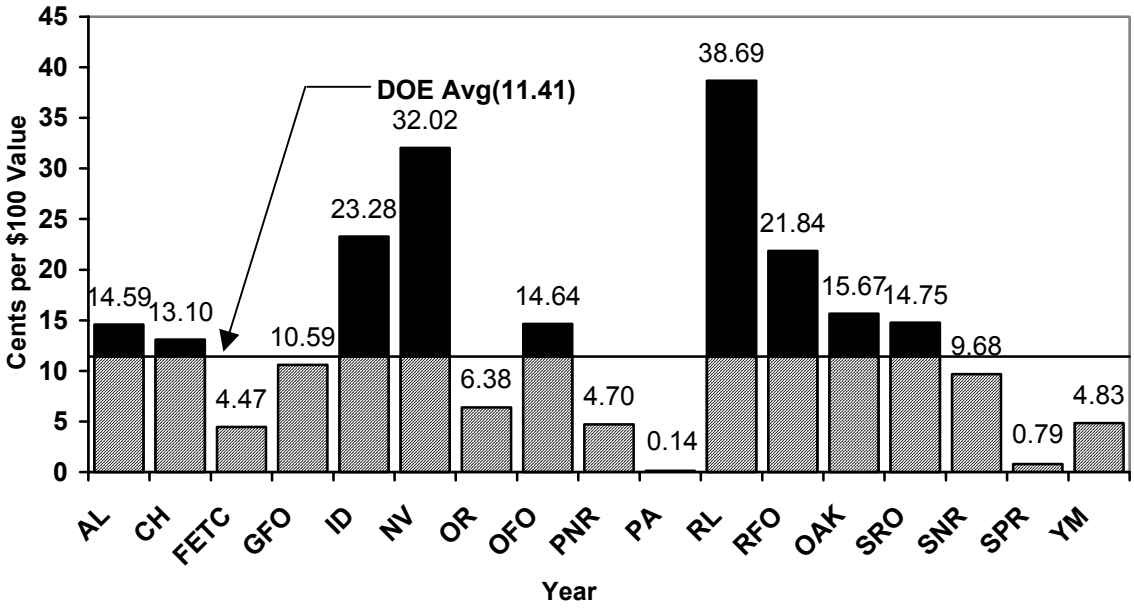
Recurring Fire Protection Cost Distribution



- Fire Department Activities

Figure 12

Cost Rate by Operations Office



The following is a summary of fire department responses for CY 1999.These numbers represent data sent in from approximately 27 fire departments stationed at DOE sites.

1.	Fire	703
2.	Hazardous Materials	436
3.	Other Emergency	3,243
4.	Other Non-Emergency	3,663
5.	Medical	1,929
	Total	9,974

Comparing this data to the actual type of response is difficult since sites do not report incident responses in a consistent fashion. The Office of Environment, Safety and Health is examining the use of a standard reporting format which complies with the National Fire Protection Association's Guide 901,"Uniform Coding for Fire Protection" that could be linked to other DOE incident reporting programs for an accurate and cost effective approach to data collection in DOE. Other options, such as folding DOE's fire data collection into State or National programs such as the National Fire Incident Reporting System, are also being considered.

CONCLUSION

Loss characteristics reported in this document are generated from annual reports sent to headquarters from field elements. These reports have historically shown that DOE's approach to estimating property loss is incomplete to the benefit of the DOE (i.e. the Department's actual losses exceed its reported losses). A likely cause of this discrepancy is the multitude of data requests that need processing for any single event as well as lack of uniform guidance on the definition and quantification of the loss. An attempt to rectify the situation currently is underway to streamline the mechanics of data collection by consistently defining loss terms and reporting attributes.

A comparison of the DOE's recurring fire protection cost to private industry costs is difficult to obtain since no comparable industry data exists. If the DOE were, however, to match its fire loss rate to that of the private sector, DOE would have to incur losses of over 6.3 million dollars to meet comparable industry losses for CY-1999. DOE's recorded fire losses of less than $450,000. Is an indication that the department's fire protection programs are successful at managing fire risk.